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Efficiency Strategy for Procurement of Raw Materials for Side Beam for Bogie with Material Requirement Planning at PT XYZ

Rosyid Abdullah*, Suseno
Department of Industrial Engineering, Faculty of Science and Technology, Yogyakarta University of Technology, D.I. Yogyakarta, 55164, Indonesia
*Corresponding Author: rosyidabdullah1712@gmail.com

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ABSTRACT
Companies in Indonesia must find the right solution in order to survive and compete in the era of globalization. Price competition is an important strategy in the competition between similar companies. Based on this, there is a need for a good understanding in the company regarding strategic financing planning in order to achieve predetermined goals efficiently. This efficiency can be characterized by minimal cost expenditure in order to obtain maximum profit. One way to get maximum profit is by implementing good inventory management PT XYZ is a train manufacturing company in Southeast Asia. The company produces various types of trains. There is a production planning for the Train XYZ project with a total production of 526 units of train components for the Side Beam for Bogie. Procurement of these raw materials, PT XYZ uses Lot for Lot (LFL) at a cost of Rp1,411,402. The use of the LFL system still has shortcomings, namely problems due to late delivery and inefficient procurement in terms of financing. The results of production planning research with several MRP methods that have been compared, it is concluded that POQ lot sizing is the most efficient procurement of raw materials other than LFL. In detail, the total cost with the POQ method amounted to Rp1,243,140 and decreased by 11.9%. The cost consists of procurement costs of Rp781,162 and storage costs of Rp461,978.
Keyword: Companies, Efficiency, Lot Sizing, MRP, Production Planning

ABSTRAK
Perusahaan-perusahaan di Indonesia harus menemukan solusi yang tepat agar dapat bertahan dan bersaing di era globalisasi. Persaingan harga merupakan strategi yang penting dalam persaingan antar perusahaan sejenis. Berdasarkan hal tersebut, maka perlu adanya pemahaman yang baik dalam perusahaan mengenai perencanaan pembiayaan yang strategis agar dapat mencapai tujuan yang telah ditetapkan secara efisien. Efisiensi ini dapat ditandai dengan pengeluaran biaya yang minimal untuk mendapatkan laba yang maksimal. Salah satu cara untuk mendapatkan laba yang maksimal adalah dengan menerapkan manajemen persediaan yang baik. PT XYZ merupakan perusahaan manufaktur kereta api di Asia Tenggara. Perusahaan ini memproduksi berbagai macam jenis kereta api. Terdapat perencanaan produksi untuk proyek Kereta Api XYZ dengan total produksi sebanyak 526 unit komponen kereta api untuk jenis Side Beam untuk Bogie. Pengadaan bahan baku tersebut, PT XYZ menggunakan Lot for Lot (LFL) dengan biaya Rp1.411.402. Penggunaan sistem LFL masih memiliki kekurangan yaitu permasalahan akibat keterlambatan pengiriman dan pengadaan yang tidak efisien dari segi pembiayaan. Hasil penelitian perencanaan produksi dengan beberapa metode MRP yang telah dibandingkan, disimpulkan bahwa lot sizing POQ merupakan pengadaan bahan baku yang paling efisien selain LFL. Secara rinci, total biaya dengan metode POQ sebesar Rp1.243.140 dan mengalami penurunan sebesar 11,9%. Biaya tersebut terdiri dari biaya pengadaan sebesar Rp781.162 dan biaya penyimpanan sebesar Rp461.978.
Keyword: Efisiensi, Lot Sizing, MRP, Perencanaan Produksi, Perusahaan

1. Introduction

Companies in Indonesia must find the right solution in order to survive and compete in the era of globalization. Price competition is one of the important strategies in competition between other similar companies (competitors). One of the main determinants of a price is cost [1]. The definition of cost in a broad sense is the sacrifice of economic resources in the form of money to achieve goals, including those that have occurred, have not occurred, or are being planned [2]. Based on the description above, it is necessary to have a good understanding in the company regarding strategic financing planning. Strategic financing intends to achieve predetermined goals efficiently. Achieving these efficient goals can be characterized by spending minimal costs in order to obtain maximum profit.

One way to get maximum profit is by implementing good inventory management [3]. One part of inventory management is Material Requirement Planning (MRP). MRP is a system that helps determine the type, time, and amount of raw materials or components needed in a production plan [4]. MRP aims to streamline production needs so that raw materials, components, sub-assemblies can be imported at the right time and in the right amount [5].

There are several studies that have been conducted for material planning with the MRP approach. Based on the results of research conducted in pizza making, the procurement cost using the EOQ method is more efficient at a cost of Rp4,883,552,548.5, and there is a savings of Rp16,478,717,452.5 [6]. Research at PT Aneka Adhilogam Karya, found the results of the procurement of Giboult Joint PVC material that using POQ got the most efficient results. Expenditures using POQ amounted to Rp2,282,160 [7].

There is previous research on MRP using the LUC and AWW methods. Research at PT XYZ found that the LUC method has the most optimal cost. The cost is Rp58,371,267.69. This value is lower than the LFL method with a cost of Rp5,563,286,700.48 [8]. Research at PT ABC obtained results with the Wagner Within Algorithm method of Rp3,580,000. This cost is lower than the EOQ method with a result of Rp34,466,700 [9].

PT XYZ is the first integrated state-owned railway manufacturing company in Southeast Asia. PT XYZ operations implement the Engineering to Order (ETO) system. This system then makes PT XYZ in each production process produce products that have different characteristics according to customer orders. There is a train production plan for the Train XYZ project with a total production of 526 units of train components for the Side Beam for Bogie. Procurement of these raw materials, PT XYZ uses the (LFL) system at a cost of Rp1,411,402. The use of the LFL system still has shortcomings, namely problems due to late delivery and inefficient procurement in terms of financing.

Based on the description above, research will be conducted as an efficiency strategy for the procurement of Side Beam raw materials for Bogie. This research is different from previous research based on the object and type of comparison of lot measurement methods used as a strategy. The MRP lot selection used is in addition to the lot for lot that has been applied by the company. The types of lot measurements that will be applied in the research are Economic Order Quantity (EOQ), Periodic Order Quantity (POQ), Least Unit Cost (LUC) and Wagner-Within Algorithm (WWA). Of the four lot methods above, the most efficient procurement cost will then be selected. The selection of the most efficient cost is expected to result in costs that are close to or lower than the lot for lot raw material procurement system implemented in the company.

2. Theoretical Basic

2.1. Material Requirement Planning

Material Requirement Planning (MRP) is a production plan used for a number of finished products with respect to the grace period with the aim of determining the time and number of orders for each component of a product to be [10]. Material Requirement Planning is a method of planning and scheduling orders and storage for components that include dependent demand. These demands include raw materials, parts, sub-assemblies, and assemblies [11]. There are 4 inputs required in the MRP approach system. These approaches include the following [12]:

1. Bill of Material. The product structure or BOM is what contains information about the relationship between components for the assembly process. This information is important for determining net and gross requirements. Information in the product structure such as item numbers, the number of needs for each assembly, and item numbers. The product structure is divided into several levels. Level 0 describes the end

product. Level 1 describes the sub assembly that will form the final product if assembled. Level 2 or the level below again describes the level of sub-sub assembly which if assembled will become a sub assembly.

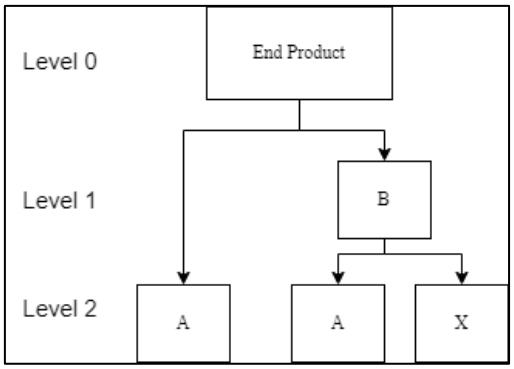

Figure 1. Bill of Material

2. Master Production Scheduling. A master production schedule is a detailed plan of how many items will be made based on units of time within a planning horizon.

3. Clarity and Accuracy of Inventory Records. The MRP work system is based on the accuracy of the inventory condition data owned. This accuracy is so that decisions in making and ordering goods can be made optimally. Based on this, the inventory level must always be monitored. If there is a difference in real (actual) data and in the computer, the data must be updated immediately according to the latest information.

4. Lead Time. The last requirement with the aim that MRP has good accuracy is to know the lead time of ordering components. Lead time is the time required from ordering an item until the item is received and ready for use. Items that are received and ready to use are items that are purchased or made by the company itself. Keep in mind that lead time is needed in MRP. This need is important because the component inventory pattern is influenced by the time phase dimension. The elements that affect the amount of lead time include the following; the length of order administration, the duration of product manufacturing set-up, the duration of delivery, length of product manufacturing process and length of queue, etc.

2.2. Lotting Method Material Requirement Planning

2.2.1. Economic Order Quantity

Economic Order Quantity is a technique by minimizing the total cost of storage and ordering costs to control inventory [13]. The EOQ equation formula is as follows [14]:

$$EOQ = \sqrt{\frac{2SD}{H}} \quad (1)$$

The description of the variables is as follows: D represents the demand/period, S is the setup cost/unit, and H is the holding cost/unit.

2.2.2. Periodic Order Quantity

The basis of the Periodic Order Quantity calculation lies in the modified EOQ concept. The modification has the aim that the approach can be used in discrete demand conditions. With the basis of the EOQ calculation, it can be obtained the number of orders that must be fulfilled based on the interval of the ordering period. The following is the interval formula of POQ [15]:

$$EOI = \frac{EOQ}{R} \quad (2)$$

The description of the variables is as follows: EOI represents the economic order intensity, EOQ stands for Economic order quantity, and R is the average demand /period.

2.2.3. Least Unit Cost

Least unit cost is a method to determine the order period by determining the smallest cost per unit [16]. LUC method sets the average cost per unit based on the cumulative increase in orders [17]. Order replenishment planning will be carried out again if there is a first increase in the cost per unit. The following is the formulation of LUC [18].

$$\frac{TRCT(T)}{\sum_{K=1}^{T} Rk} = \frac{C+Total\ h\ to\ the\ end\ T}{\sum_{K=1}^{T} Rk} \quad (3)$$

The description of the variables is as follows: C represents the ordering cost per period, H is the percentage of storage cost per period, P stands for purchase cost per unit, Ph represents the storage cost per period, TRC(T) is the total cost in period T, T denotes the time of period addition, and Rk is the average demand in the period.

2.2.4. Wagner-Within Algorithm

The Wagner-Within algorithm is an optimization based on dynamic programming model. This algorithm aims to obtain an optimal procurement strategy for the overall scheduling of net requirements by minimizing the overall procurement cost [19]. The following steps in processing the Wagner-Within Algorithm are as follows [20].

1. Calculate from the matrix (chart) the total cost of all ordering alternatives consisting of N plan periods. After that, determine Zce as the cost from period c to period e when an order is placed in period c to fulfil the demand from period c to period e. The equation for Zce is formulated as follows:

$$Zce = A+h \sum_{t=c}^{e}(qce - qct) \text{ for } 1 \leq c \leq e \leq N \quad (4)$$

$$qct = \sum_{t=c}^{e} Dt \quad (5)$$

2. Calculate the value of fN where fN is expressed as the minimum cost that can occur from period e to period n

$$Fe = Min(Zce + fc\text{-}1) \text{ for } e = 1, 2, 3 \quad (6)$$

The description of the variables is as follows: A represents the ordering cost, h is the storage cost, Dt is the demand in period t, c is the initial limit of qct order period coverage, and n is the final limit of coverage of the qct ordering period.

In each period, all possible combinations of ordering alternatives are considered. The best result of the combination is saved as the best strategy fN to fulfill the demand from period e to period n. The price fN is the optimal value of the ordering method up to period n.

3. Translate fN into lot size, time to order, and storage cost calculations. The translation can be done in the following way:
   a) The last order is placed in period w in order to accommodate the needs from period w to N

$$fN = Own + fw\text{-}1 \quad (7)$$

   b) Orders placed before the last order must be placed in period v to accommodate the needs from period v to w-1.

$$fw\text{-}1 = Fw\text{-}1 + fv\text{-}1 \quad (8)$$

   c) The first order should be placed in period 1 to accommodate the demand from period u to period

$$u\text{-}1.Fu\text{-}1 = 01u\text{-}1 + f0 \quad (9)$$

3. Research Method

3.1. Introduction

Introduction is the first step in the research. The introduction was carried out by conducting an interview with the production manager. This interview aims to ask the topic of problems that occur in the company that can be raised in research.

3.2. Field Studies

After the production manager approved, the next step was the field study. Field studies are carried out by observing field conditions and conducting interviews with competent sources in the field (production floor).

3.3. Problem Formulation

The problem formulation stage aims to identify problems based on the results of the field study stage carried out previously.

3.4. Research Objective

Goal setting is done when the formulation of the problem under study is clear. This goal setting has a function as a basis for making the research carried out more focused.

3.5. Data Collection

Data collection is carried out to collect data that will be used for research. This collection consists of primary and secondary data.

3.6. Data Processing

The complete data was collected and then processed in accordance with the rules in the theoretical basis in the literature study.

3.7. Result and Discussion

The result and discussion step is carried out with the aim of translating the results of processing in order to get a conclusion.

3.8. Conclusions

The step to draw conclusions is based on the results of the discussion obtained. The conclusion is generated by comparing the results of the method that has the most minimal cost as a suggestion of findings to answer the problems raised.

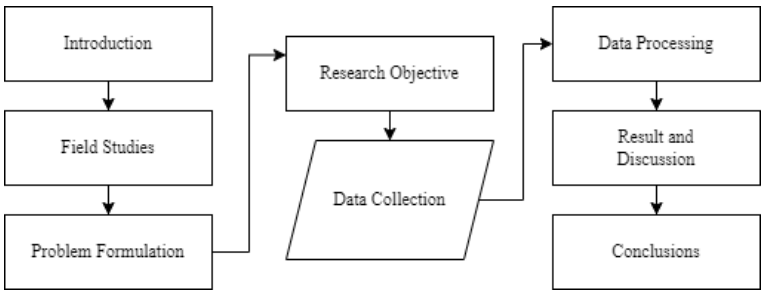

Figure 2. Research Diagram

4. Result and Discussion

4.1. Economic Order Quantity

The following are the results of processing material procurement costs using Economic Order Quantity (EOQ).

Table 1. EOQ Result

Component	EOQ		
	Setup Cost (IDR)	Holding Cost (IDR)	Total Cost (IDR)
Side Beam For Bogie	-	-	-
Part_XYZ_1	-	-	-
Part_XYZ_1.1	301,599.00	268,400.00	569,999.00
Part_XYZ_1.2	29,904.00	36,335.00	66,239.00
Part_XYZ_1.3	-	-	-
Part_XYZ_1.3.1	5,460.00	6,032.00	11,492.00
Part_XYZ_1.3.2	1,703.00	1,803.00	3,506.00
Part_XYZ_1.4	507.00	425.00	932.00
Part_XYZ_1.5	2,805.00	3,660.00	6,465.00
Part_XYZ_1.6	930.00	1,936.00	2,866.00
Part_XYZ_2	-	-	-
Part_XYZ_2.1	301,869.00	268,400.00	570,269.00
Part_XYZ_2.2	18,522.00	16,800.00	35,322.00
Part_XYZ_2.3	22,221.00	20,000.00	42,221.00
Part_XYZ_2.4	22,221.00	20,000.00	42,221.00
Part_XYZ_2.5	18,522.00	16,800.00	35,322.00
Part_XYZ_2.6	22,221.00	20,000.00	42,221.00
Part_XYZ_2.7	9,585.00	8,800.00	18,385.00
Part_XYZ_2.8	3,766.00	5,544.00	9,310.00
Part_XYZ_2.9	9,549.00	9,636.00	19,185.00
Part_XYZ_2.10	9,549.00	9,636.00	19,185.00
Part_XYZ_2.11	9,549.00	9,636.00	19,185.00
Part_XYZ_2.12	9,549.00	9,636.00	19,185.00

Component	EOQ		
	Setup Cost (IDR)	Holding Cost (IDR)	Total Cost (IDR)
Part_XYZ_2.13	-	-	-
Part_XYZ_2.13.1	14,924.00	14,605.00	29,529.00
Part_XYZ_2.13.2	15,548.00	15,240.00	30,788.00
Part_XYZ_2.14	1,417.00	2,328.00	3,745.00
Part_XYZ_2.15	2,145.00	1,760.00	3,905.00
Part_XYZ_2.16	3,952.00	4,207.00	8,159.00
Part_XYZ_2.17	21,788.00	6,800.00	28,588.00
Part_XYZ_2.18	4,446.00	4,256.00	8,702.00
Part_XYZ_2.19	7,083.00	6,400.00	13,483.00
Part_XYZ_2.20	13,221.00	10,416.00	23,637.00
Part_XYZ_2.21	360.00	602.00	962.00
Part_XYZ_2.22	624.00	496.00	1,120.00
Part_XYZ_2.23	624.00	496.00	1,120.00
Total	886,163.00	801,085.00	1,687,248.00

Based on MRP processing with the EOQ method, the total cost for procuring Side Beam for Bogie material is Rp1,687,248. The cost consists of setup cost of Rp886,163 and holding cost of Rp801,085. Procurement of raw materials with the EOQ method results in higher costs than Lot for Lot. The cost difference between Lot for Lot and EOQ is Rp275,846.

4.2. Periodic Order Quantity

The following are the results of processing material procurement costs using Periodic Order Quantity (POQ).

Table 2. POQ Result

Component	POQ		
	Setup Cost (IDR)	Holding Cost (IDR)	Total Cost (IDR)
Side Beam For Bogie	-	-	-
Part_XYZ_1	-		-
Part_XYZ_1.1	8,088.00	162,382.00	430,470.00
Part_XYZ_1.2	2,040.00	-	32,040.00
Part_XYZ_1.3	-	-	-
Part_XYZ_1.3.1	5,460.00	-	5,460.00
Part_XYZ_1.3.2	1,048.00	1,452.00	2,500.00
Part_XYZ_1.4	312.00	484.00	796.00
Part_XYZ_1.5	2,805.00	-	2,805.00
Part_XYZ_1.6	930.00	-	930.00
Part_XYZ_2	-	-	-
Part_XYZ_2.1	268,328.00	162,382.00	430,710.00
Part_XYZ_2.2	16,464.00	10,164.00	26,628.00
Part_XYZ_2.3	19,752.00	12,100.00	31,852.00
Part_XYZ_2.4	19,752.00	12,100.00	31,852.00
Part_XYZ_2.5	16,464.00	10,164.00	26,628.00
Part_XYZ_2.6	19,752.00	12,100.00	31,852.00
Part_XYZ_2.7	8,520.00	5,324.00	13,844.00
Part_XYZ_2.8	4,035.00	-	4,035.00
Part_XYZ_2.9	8,488.00	5,324.00	13,812.00
Part_XYZ_2.10	8,488.00	5,324.00	13,812.00
Part_XYZ_2.11	8,488.00	5,324.00	13,812.00
Part_XYZ_2.12	8,488.00	5,324.00	13,812.00
Part_XYZ_2.13	-	-	-
Part_XYZ_2.13.1	9,184.00	11,132.00	20,316.00

Component	POQ		
	Setup Cost (IDR)	Holding Cost (IDR)	Total Cost (IDR)
Part_XYZ_2.13.2	9,568.00	11,616.00	21,184.00
Part_XYZ_2.14	872.00	1,452.00	2,324.00
Part_XYZ_2.15	1,320.00	1,936.00	3,256.00
Part_XYZ_2.16	2,432.00	3,388.00	5,820.00
Part_XYZ_2.17	1,788.00	4,114.00	25,902.00
Part_XYZ_2.18	2,736.00	3,388.00	6,124.00
Part_XYZ_2.19	6,296.00	3,872.00	10,168.00
Part_XYZ_2.20	8,136.00	10,164.00	18,300.00
Part_XYZ_2.21	360.00	-	360.00
Part_XYZ_2.22	384.00	484.00	868.00
Part_XYZ_2.23	384.00	484.00	868.00
Total	781,162.00	461,978.00	1,243,140.00

Based on MRP processing with the POQ method, the total cost for procuring Side Beam for Bogie material is Rp1,243,140. The cost consists of setup costs of Rp781,162 and holding costs of Rp461,978. Procurement of raw materials using the POQ method results in lower costs than Lot for Lot. The cost difference between POQ and Lot for Lot is Rp168,262.

4.3. Least Unit Cost

The following are the results of processing material procurement costs using Least Unit Cost (LUC).

Table 3. LUC Result

Component	LUC		
	Setup Cost (IDR)	Holding Cost (IDR)	Total Cost (IDR)
Side Beam For Bogie	-	-	-
Part_XYZ_1	-	-	-
Part_XYZ_1.1	268,088.00	162,382.00	430,470.00
Part_XYZ_1.2	17,088.00	41,624.00	58,712.00
Part_XYZ_1.3	-	-	-
Part_XYZ_1.3.1	2,912.00	7,744.00	10,656.00
Part_XYZ_1.3.2	1,048.00	1,452.00	2,500.00
Part_XYZ_1.4	312.00	484.00	796.00
Part_XYZ_1.5	1,496.00	3,872.00	5,368.00
Part_XYZ_1.6	496.00	3,872.00	4,368.00
Part_XYZ_2	-	-	-
Part_XYZ_2.1	68,328.00	162,382.00	430,710.00
Part_XYZ_2.2	16,464.00	10,164.00	26,628.00
Part_XYZ_2.3	19,752.00	12,100.00	31,852.00
Part_XYZ_2.4	19,752.00	12,100.00	31,852.00
Part_XYZ_2.5	16,464.00	10,164.00	26,628.00
Part_XYZ_2.6	19,752.00	12,100.00	31,852.00
Part_XYZ_2.7	8,520.00	5,324.00	13,844.00
Part_XYZ_2.8	2,152.00	8,712.00	10,864.00
Part_XYZ_2.9	8,488.00	5,324.00	13,812.00
Part_XYZ_2.10	8,488.00	5,324.00	13,812.00
Part_XYZ_2.11	8,488.00	5,324.00	13,812.00
Part_XYZ_2.12	8,488.00	5,324.00	13,812.00
Part_XYZ_2.13	-	-	-
Part_XYZ_2.13.1	9,184.00	11,132.00	20,316.00
Part_XYZ_2.13.2	9,568.00	11,616.00	21,184.00
Part_XYZ_2.14	872.00	1,452.00	2,324.00

Component	LUC		
	Setup Cost (IDR)	Holding Cost (IDR)	Total Cost (IDR)
Part_XYZ_2.15	1,320.00	1,936.00	3,256.00
Part_XYZ_2.16	2,432.00	3,388.00	5,820.00
Part_XYZ_2.17	1,788.00	4,114.00	5,902.00
Part_XYZ_2.18	2,736.00	3,388.00	6,124.00
Part_XYZ_2.19	6,296.00	3,872.00	10,168.00
Part_XYZ_2.20	8,136.00	10,164.00	18,300.00
Part_XYZ_2.21	192.00	1,936.00	2,128.00
Part_XYZ_2.22	384.00	484.00	868.00
Part_XYZ_2.23	384.00	484.00	868.00
Total	759,868.00	529,738.00	1,289,606.00

Based on MRP processing with the LUC method, the total cost for procuring Side Beam for Bogie material is Rp1,289,606. The cost consists of setup cost of Rp759,868 and holding cost of Rp529,738. Procurement of raw materials using the LUC method results in lower costs than Lot for Lot. The cost difference between LUC and Lot for Lot is Rp121,796.

4.4. Wagner-Within Algorithm

The following are the results of processing material procurement costs using Wagner-Within Algorithm (WWA).

Table 4. WWA Result

Component	WWA		
	Setup Cost (IDR)	Holding Cost (IDR)	Total Cost (IDR)
Side Beam For Bogie	-	-	-
Part_XYZ_1	-	-	-
Part_XYZ_1.1	268,088.00	199,958.00	468,046.00
Part_XYZ_1.2	2,136.00	-	2,136.00
Part_XYZ_1.3	-	-	-
Part_XYZ_1.3.1	364.00	-	364.00
Part_XYZ_1.3.2	1,834.00	108.00	1,942.00
Part_XYZ_1.4	546.00	36.00	582.00
Part_XYZ_1.5	2,805.00	-	2,805.00
Part_XYZ_1.6	930.00	-	930.00
Part_XYZ_2	-	-	-
Part_XYZ_2.1	301,869.00	78,486.00	480,355.00
Part_XYZ_2.2	19,752.00	14,900.00	34,652.00
Part_XYZ_2.3	19,752.00	14,900.00	34,652.00
Part_XYZ_2.4	19,752.00	14,900.00	34,652.00
Part_XYZ_2.5	16,464.00	12,516.00	28,980.00
Part_XYZ_2.6	19,752.00	14,900.00	34,652.00
Part_XYZ_2.7	8,520.00	6,556.00	15,076.00
Part_XYZ_2.8	4,035.00	-	4,035.00
Part_XYZ_2.9	8,488.00	6,556.00	15,044.00
Part_XYZ_2.10	8,488.00	6,556.00	15,044.00
Part_XYZ_2.11	8,488.00	6,556.00	15,044.00
Part_XYZ_2.12	6,556.00	6,556.00	13,112.00
Part_XYZ_2.13	-	-	-
Part_XYZ_2.13.1	16,744.00	828.00	17,572.00
Part_XYZ_2.13.2	16,744.00	864.00	17,608.00
Part_XYZ_2.14	1,526.00	108.00	1,634.00
Part_XYZ_2.15	2,310.00	144.00	2,454.00

Component	WWA		
	Setup Cost (IDR)	Holding Cost (IDR)	Total Cost (IDR)
Part_XYZ_2.16	4,256.00	252.00	4,508.00
Part_XYZ_2.17	21,788.00	5,066.00	26,854.00
Part_XYZ_2.18	4,788.00	252.00	5,040.00
Part_XYZ_2.19	6,296.00	4,768.00	11,064.00
Part_XYZ_2.20	14,238.00	756.00	14,994.00
Part_XYZ_2.21	360.00	-	360.00
Part_XYZ_2.22	672.00	36.00	708.00
Part_XYZ_2.23	672.00	36.00	708.00
Total	809,013.00	496,594.00	1,305,607.00

Based on MRP processing with the WWA method, the total cost for procuring Side Beam for Bogie material is Rp1,305,607. The cost consists of setup cost of Rp809,013 and holding cost of Rp496,594. Procurement of raw materials using the WWA method results in lower costs than Lot for Lot. The cost difference between WWA and Lot for Lot is Rp105,795.

5. Conclusions

Based on the results obtained, the Periodic Order Quantity (POQ) method has the lowest results compared to other methods used for research. The cost difference is Rp168,262 or a decrease of 11.9% compared to the procurement of the company's lot for lot method. On the other hand, the POQ method has several patterns that are carried out for simultaneous cumulative purchases of 2 periods. The pattern has a difference with the lot for lot applied by the company. Based on this, the Periodic Order Quantity (POQ) method can be concluded to be the right strategy because it has the most efficient costs along with procurement patterns that can overcome delays.

References

[1] Agusra. “Penetapan Harga Jual Pada Bofet Martabak Kubang Wadesta Bandar Buat”, Fakultas Ekonomi, Universitas Muhammadiyah Sumatera Barat, Suratno. Yuliyanto, W & Khasanah, U, Analisis Perbandingan Harga Pokok Produksi Metode Full Costing dan Variabel Costing Pada CV Gemilang Kencana Wonosobo, *Jurnal E-Bis 5(1)*, pp 55-66, 2021.

[2] Suratno. Yuliyanto, W & Khasanah, U, Analisis Perbandingan Harga Pokok Produksi Metode Full Costing dan Variabel Costing Pada CV Gemilang Kencana Wonosobo, *Jurnal E-Bis 5(1)*, pp 55-66, 2021.

[3] Kadafi, A, M & Delvina, A, “Analisis Pengendalian Persediaan Bahan Baku dengan Safety Stock Optimum Analysis Of Raw Material Inventory Control with Optimum Safety Stock”, *Jurnal Forum Ekonomi*, vol. 23, no 53, pp 553-560, 2021.

[4] Uyun, S, Z, Indrayanto, A, Kurniasih, R, "Analisis Pengendalian Persediaan Bahan Baku Dengan Menggunakan Metode Material Requirement Planning (MRP) 1". *Jurnal Ekonomi, Bisnis, dan Akuntansi (JEBA)*, vol 22, no 1, 2020.

[5] Martha, K, A & Setiawan, P, Y, “Analisis Material Requirement Planning Produk Coconut Sugar Pada Kul-Kul Farm”, *E-Jurnal Manajemen Universitas Udayana*, vol 7, no 12, pp 6532-6560, 2018.

[6] Wibowo, W, A, " Efficency of Procurement of Main Raw Materials for Pizza Makers with Economic Order Quantity (EOQ) Approach", *International Journal of Social and Management Studies*, vol. 3, no. 4, hh. 64-67, 2022.

[7] Suseno & Rifa”I, M, R, “Analisis Pengendalian Persediaan Bahan Baku dengan Metode Material Requirement Planning (Studi Kasus : PT. Aneka Adhilogam Karya)”, *Jurnal Cakrawala Ilmiah*, vol 1, no 7, pp 1757–1768, 2022.

[8] Zahra, Z, S & Fahma, F. (2020). “Implementasi Metode MRP untuk Pengendalian Bahan Baku Produk ABC Pada PT XYZ”, *Seminar dan Konferensi Nasional IDEC 2020*, 2 November 2020.

[9] Afrinda, D, P & Fahryan, M, “Perencanaan Produksi Lampu Emergency pada Material Requirement Planning dengan Menggunakan Metode Algoritma Wagner Within dan Economic Order Quantity (EOQ)”, *TALENTA Conference Series*, seri 6, pp 952-959, 2023.

[10] Utama, R, E, Jaharudin, N, A, G, Priharta, A, “Manajemen Operasi”, Universitas Muhammadiyah Jakarta, Jakarta, 2019.

[11] Juniarti, T, A, Luxviyanta, C, A, “Metode Pengendalian Persediaan dengan MRP”, CV Pena Persada, Purwokerto, 2021.

[12] Abd"rachim, E, A,"Manajemen Produksi", PT Perca, Jakarta, 2021.
[13] Millenia, T, F, Sudarwadi, D, Nurlaela, "Pengendalian Persediaan Bahan Baku Menggunakan Metode EOQ dan MRP PADA CV. Ozone Graphics di Manokwari", *Jurnal Maneksi,* vol 11, no 2, pp 322-331, 2022.
[14] Abbas, S, R, Citraningtyas G, Mansauda, K, L, R, "Inventory Control of Drug with Economic Order Quantity (EOQ) and Reorder Point (ROP) Methods in X Pharmacy, District Wenang". *Jurnal Pharmacon,* vol 10, no 4, pp 927-932, 2021.
[15] Purbasari, A, Irwan, H, Apostolic, W, "Analisis Perbandingan Metode Economic Order Quantity (EOQ) dan Periodic Order Quantity (POQ) dalam Pengendalian Persediaan Bahan Cutting Disk dan Carbon Gouging di PT. STP", *Profisiensi: Jurnal Program Studi Teknik Industri,* vol 10, no 1, pp 1-16, 2022.
[16] Fatma, E, Indriani, I, R, Fitriana, M, "Perencanaan Persediaan Komponen pada Perusahaan Original Equipment Manufacturer Menggunakan Metode Persediaan Deterministik Dinamis", *Jurnal Spektrum Industri,* vol 17, no 7, pp 23-30, 2019.
[17] Khan, N, A, Sitania, F, D, Wahyuda, "Analisis Perbandingan Metode Least Unit Cost, Silver Meal, dan Metode Perusahaan dalam Pengendalian Persediaan Plafon PVC (Studi Kasus : XYZ)", *G-Tech: Jurnal Teknologi Terapan,* vol 7, no 1, pp 155-164, 2023.
[18] Madinah, W, N, Sumantri, Y, Azlia, W, "Penentuan Metode Lot Sizing Pada Perencanaan Pengadaan Bahan Baku Kikir dan Mata Bor", *Jurnal Rekayasa dan Manajemen Sistem Industri,* vol 3, no 3, pp 505-515, 2015.
[19] Asmal, S, Setiawan, I, Ikasari, N, Adriani, Y, "Inventories Analysis of Animal Feed Raw Materials by Using the Silver Meal Method and Wagner within Algorithm (Case Study of PT. XYZ Makassar)", *The 3rd EPI International Conference on Science and Engineering,* vol 875, 2020.
[20] Yuliastuti, E, Jauhari, W, A, Rosyidi, C, N, "Pengendalian Persediaan Bahan Baku Kain pada Departemen Printing-Dyeing PT. Kusumahadi Santosa Karanganyar dengan Algoritma Wagner Whitin", Prosiding, Universitas Sebelas Maret, 2015.
[21] Ptak, A, C, CFPIM, CIRM, Smith Chad J, "Orlicky's Material Requirement Planning Third Edition. Mc Graw Hill", MC Graw Hill, 2011.